TOTAL MAXIMUM DAILY LOAD
FOR THE SANTA FE RIVER
FOR DISSOLVED OXYGEN AND pH

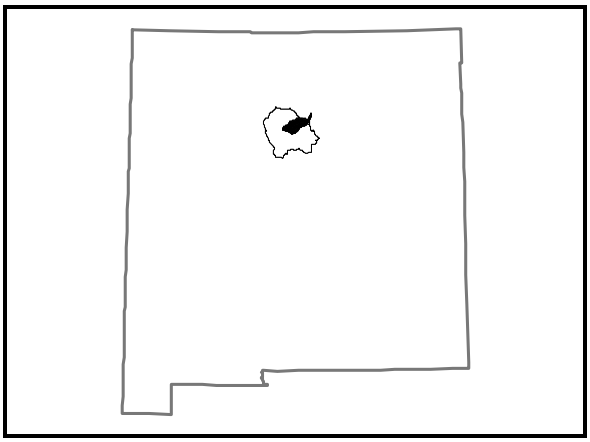


Figure 1. Santa Fe River Watershed, New Mexico

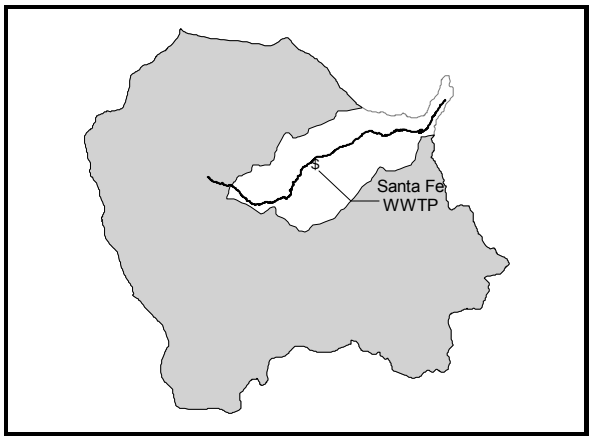


Figure 2. Santa Fe River Study Area

Summary Table

New Mexico Standards Segment	Santa Fe River, (20.6.4.113, formerly 2110)
Waterbody Identifier	Santa Fe River from the Cochiti reservoir upstream to the outfall of the Santa Fe wastewater treatment facility (12.7 mi)
Parameters of Concern	Dissolved oxygen and pH
Uses Affected	Marginal Coldwater Fishery, Warmwater Fishery, Livestock Watering, Irrigation, and Secondary Contact
Geographic Location	Upper Rio Grande Basin, Santa Fe River Watershed, Santa Fe River
Scope/size of Watershed	249 mi^2
Land Type	Ecoregions: Arizona-New Mexico Plateau Southern Rockies
Land Use/Cover	Forest Land (57.7%), Rangeland (28.9%), Urban or Built-up Land (10.0%), Agricultural Land (2.3%), Other (1.2%)
Identified Sources	Municipal point sources
Priority Ranking	6
Threatened and Endangered Species	None
TMDL for: CBOD5 CBODu NH3-N Nitrate+Nitrite DO pH range	WLA + LA + MOS = TMDL 708.9 + 0.00 + 0.00 = 708.9 lbs/day (CBOD5 Conc. of 10 mg/L) 1985.0 + 0.00 + 0.00 = 1985.0 lbs/day (CBODu Conc. of 28 mg/L) 141.78 + 0.00 + 0.00 = 141.78 lbs/day (NH3-N Conc. of 2 mg/L 212.67 + 0.00 + 0.00 = 212.67 lbs/day (Nitrate+Nitrite Conc. of 3 mg/L) In practical applications, the DO and pH limits are expressed in terms of concentrations (DO in mg/L and pH in S.U.) rather than in loads (lbs/day), therefore, the TMDLs for DO and pH are as follows: 5.0 mg/L 6.6 S.U. to 9.0 S.U.

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Section 303(d) of the Federal Clean Water Act requires states to develop TMDL management plans for water bodies determined to be water quality limited. A TMDL documents the amount of a pollutant a water body can assimilate without violating a state's water quality standards. It also allocates that load capacity to known point sources and nonpoint sources at a given flow. TMDLs are defined in 40 CFR Part 130 as the sum of the individual waste load allocations (WLAs) for point sources and load allocations (LAs) for nonpoint sources and a margin of safety (MOS).

The Santa Fe River Study Area is a sub-basin of the Upper Rio Grande Basin, located in north central New Mexico. Historically (prior to January 1998), several synoptic surveys were conducted-along the Santa Fe River to evaluate water quality standards. As a result of this information, chlorine, pH, metals, stream bottom deposits (siltation), total ammonia (as a toxic), and gross alpha (radioactivity) were identified as pollutants causing the lack of full support of designated uses in previous 303(d) lists. Numerous changes in the watershed including restoration work at the La Bajada mine, upgrades at the City of Santa Fe WWTP, and additional water quality data collections have led to parameters being removed from this list. For example, the fieldwork associated with the La Bajada mine restoration was completed in 1996. Based on monitoring since completion of restoration activities at the La Bajada mine it has been determined that the Santa Fe River currently meets the numeric water quality standards for gross alpha. In 1998 the Santa Fe WWTP completed treatment upgrades to eliminate the use of chlorine and significantly lower ammonia, BOD, and TSS discharges from the plant. Metals was removed as a cause for non-support in the State 1998 303(d) list based on sampling from this same period. Recent monitoring (Fall 1998 through Summer 1999) has also demonstrated that the Santa Fe River now meets water quality standards for total ammonia. Therefore, TMDLs were not developed for gross alpha, total ammonia, or metals. TMDLs were completed and approved for chlorine and stream bottom deposits in December 1999.

Sampling efforts during 1998-2000 continued to support the 303(d) listings for dissolved oxygen (DO) and pH and the need to develop TMDLs for these parameters. The 303(d) listing for DO and pH is the result of algal growth in response to plant nutrients available from the stream bottom. The excessive algal growth contributes to severe diurnal swings in both DO and pH. These swings have resulted in violations below the existing DO standard of 6.0 mg/l and above the pH standard threshold of 9.0. On August 8, 2000, the New Mexico Water Quality Control Commission adopted the revised language for the dissolved oxygen criteria for segment 20.6.4.113 (formerly 20 NMAC 6.1.2110) of the Santa Fe River in Rio Grande Basin. The segment 20.6.4.113 (formerly 20 NMAC 6.1.2110) includes the Santa Fe River and its tributaries from Cochiti Reservoir upstream to the outfall of the Santa Fe wastewater treatment facility.

This TMDL is being developed to address the revised dissolved oxygen and pH water quality criteria adopted by the New Mexico Water Control Commission. The proposed wasteload allocations for the City of Santa Fe wastewater treatment plant is expected to maintain the revised DO and pH water quality criteria for the Santa Fe River. Once it is demonstrated that the

water quality standards have been achieved, stream segment 20.6.4.113 (formerly 20 NMAC 6.1.2110) will be removed from New Mexico's 303(d) list for DO and pH.

An Implementation Plan was provided by the State of New Mexico Surface Water Quality Bureau (SWQB) for this document. The Implementation Plan is inserted into the text of this document and clearly marked as being contributed by the State. The Implementation Plan also includes Appendix D: Section 319 Projects in the Santa Fe Watershed. The US EPA did not participate in the development of any part of the Implementation Plan.

LIST OF ABBREVIATIONS

BLM	**United States Bureau of Land Management**
BMP	**Best Management Practice**
CBOD5	**Carbonaceous Oxygen Demand (5-day)**
CBODu	**Carbonaceous Oxygen Demand (ultimate)**
cfs	**Cubic Feet per Second**
CWA	**Clean Water Act**
CWAP	**Clean Water Action Plan**
CWF	**Coldwater Fishery**
EPA	**United States Environmental Protection Agency**
FS	**United States Department of Agriculture Forest Service**
LA	**Load Allocation**
LW	**Livestock Watering**
mgd	**Million Gallons per Day**
mg/L	**Milligrams per Liter**
mi^2	**square miles**
MCWF	**Marginal Coldwater Fishery**
MOS	**Margin of Safety**
MOU	**Memorandum of Understanding**
NH3-N	**Ammonia-Nitrogen**
NMAC	**New Mexico Administrative Code**
NMED	**New Mexico Environment Department**
NMSHD	**New Mexico State Highway and Transportation Department**
NO3-NO2	**Nitrate + Nitrite**
NPDES	**National Pollutant Discharge Elimination System**
NPS	**Nonpoint Source**
SBD	**Stream Bottom Deposits**
SU	**Standard Units (unit of measure associated with pH)**
SWQB	**Surface Water Quality Bureau**
TMDL	**Total Maximum Daily Load**
UWA	**Unified Watershed Assessment**
WLA	**Waste Load Allocation**
WQLS	**Water Quality Limited Segment**
WQCC	**Water Quality Control Commission**
WQS	**Water Quality Standards (NMAC 20.6.4)**
WRAS	**Watershed Restoration Action Strategy**
WWF	**Warmwater Fishery**
WWTP	**Wastewater Treatment Plant**
4Q3	**Four-day average low flow occurring once every three years**

BACKGROUND INFORMATION

The Santa Fe River Study Area (249 mi^2) is a sub-basin of the Upper Rio Grande Basin, located in north central New Mexico and is dominated by both forest land (57.7%), range land (28.9%), and urban land (10.0%) (Figure 3). The Santa Fe River originates in the northeast portion of the study area on land managed by the United States Department of Agriculture Forest Service (FS) and flows in a generally southwest direction toward the City of Santa Fe. Upstream of the City of Santa Fe Wastewater Treatment Plant (WWTP), the Santa Fe River is generally a dry arroyo with flow during some snowmelt periods in the spring and after some storm events. Thus, the critical point for application of many numeric water quality standards (e.g., DO and pH) is at the point of discharge into the Santa Fe River. In the 12 months ending in June 1999, the wastewater treatment plant reported an average flow of 5.9 mgd (9.1 cfs) and a maximum daily flow of 7.5 mgd (11.6 cfs) (Appendix A, Table A-1). The draft permit from the EPA (April 17, 1999) indicates a permitted average design flow of 8.5 mgd (13.2 cfs).

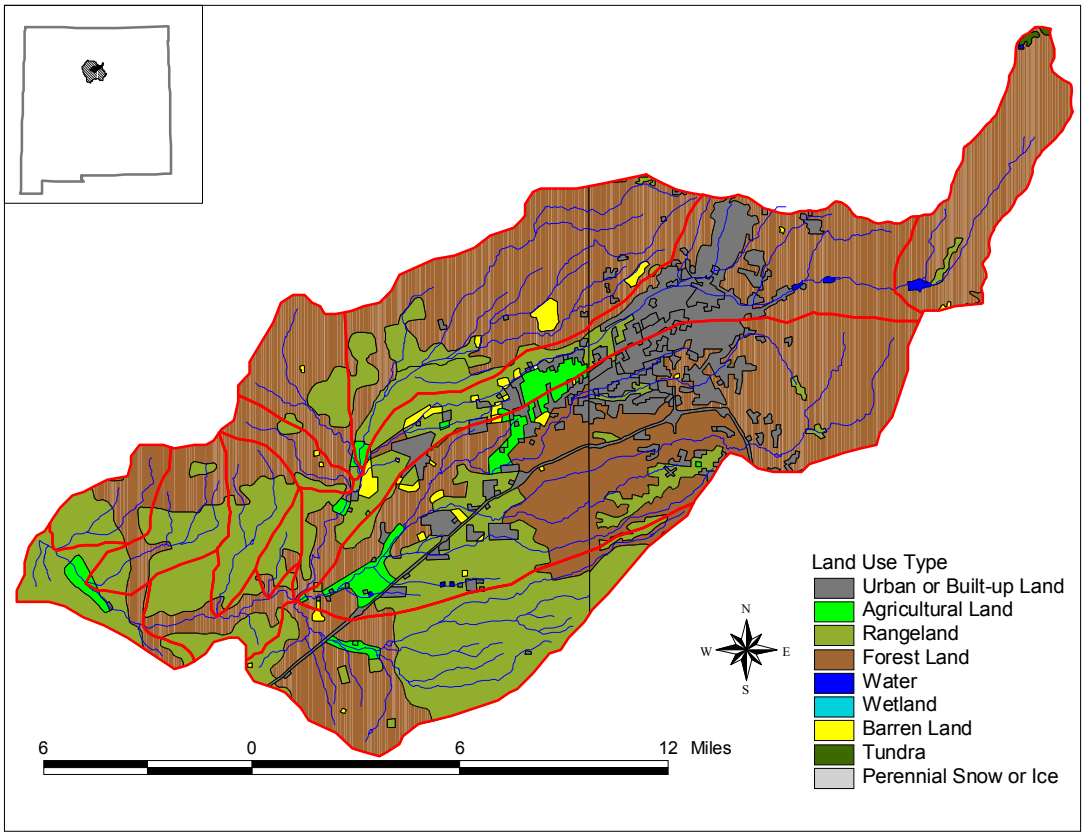


Figure 3. Land Use Classification in Study Area

Around the City of Santa Fe (the central portion of the study area), most of the land along the Santa Fe River is privately held with some interspersed state-managed land. The Bureau of Land Management (BLM) and FS manage much of the land along the Santa Fe River in the southwestern portion (below Cañon, New Mexico) of the study area. Currently, the BLM is considering acquisition of land near the confluence of the Santa Fe River and Cienega Creek, and the FS is considering land trades with Cochiti Pueblo.

Surface water quality monitoring stations were used to characterize water quality of stream reaches (Figure 4). Stations were located to evaluate the impact of the Santa Fe WWTP and Cienega Creek as well as to determine water quality conditions throughout the targeted portion of the Santa Fe River. Historical monitoring (prior to January 1998) indicates that chlorine, stream bottom deposits, metals, total ammonia, and gross alpha were at one time pollutants causing the lack of full support of designated uses. Fieldwork associated with the La Bajada mine restoration, which was a source of radioactive pollutants, was completed in 1996. Based on monitoring since restoration was completed, it has been determined that the Santa Fe River currently meets numeric water quality standards for gross alpha. Monitoring from Fall 1998 through Summer 1999 has also demonstrated that the Santa Fe River now meets water quality standards for total ammonia (related to the previous listing for ammonia toxicity, but not related to DO as covered in this TMDL). Water quality data, both historical and new survey data, did not support the metals (aluminum) listing and it was removed as a cause for non-support in the State 1998 303(d) list. Therefore, no TMDL was developed for gross alpha, total ammonia, or metals.

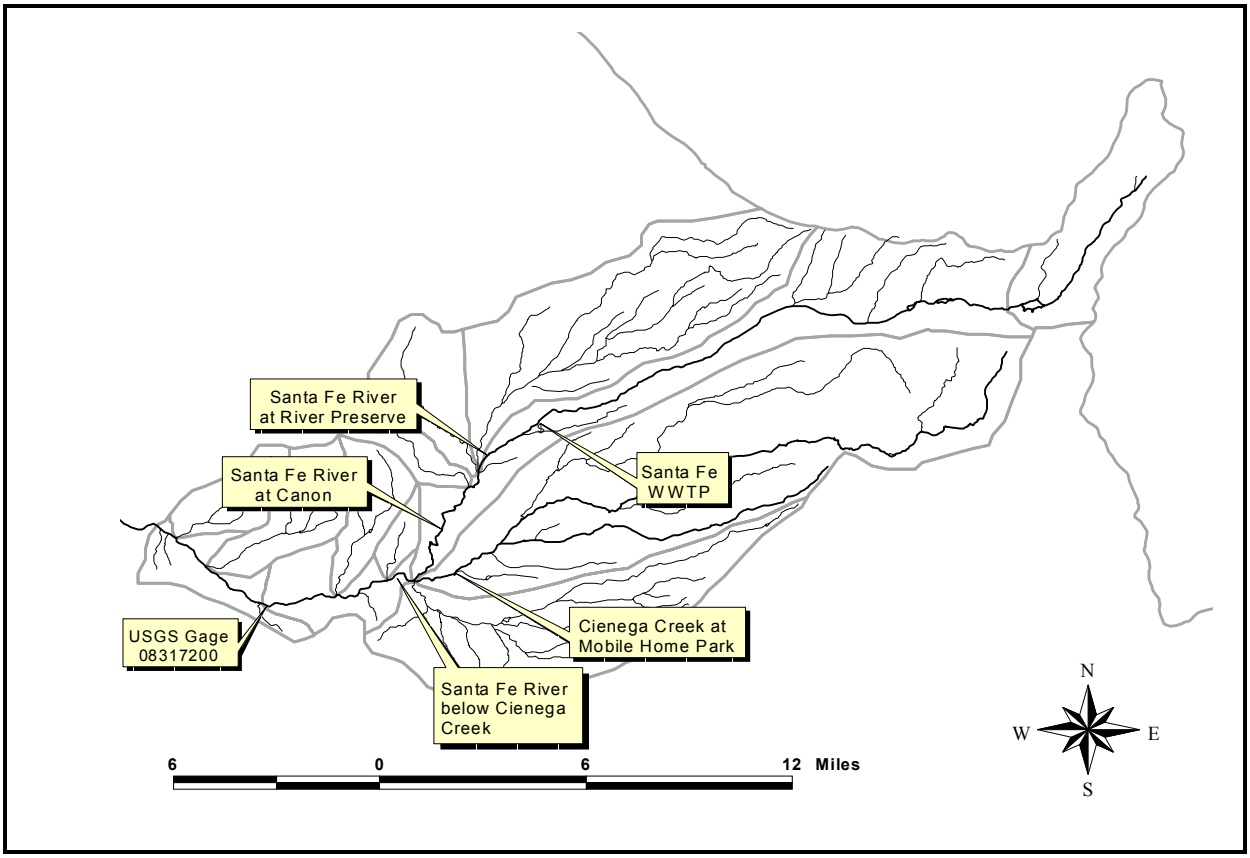


Figure 4. Location of Stream Monitoring Stations in Study Area

Endpoint Identification/Target Loading Capacity

The target value for this TMDL was determined based on 1) the presence of numeric criteria for DO and pH, 2) the degree of experience in applying the target values and 3) the ability to easily monitor and produce quantifiable and reproducible results.

Dissolved Oxygen (DO) and pH

On August 8, 2000, the New Mexico Water Quality Control Commission adopted the revised language for the dissolved oxygen criteria for segment 20.6.4.113 NMAC (formerly 20 NMAC 6.1.2110) of the Santa Fe River in Rio Grande Basin. Segment 20.6.4.113 NMAC includes the Santa Fe River and its tributaries from Cochiti Reservoir upstream to the outfall of the Santa Fe wastewater treatment facility. The revised language is as follows:

A. Designated Uses: irrigation, livestock watering, wildlife habitat, marginal coldwater fishery, secondary contact, and warm water fishery.

B. Standards:

1. In any single sample: pH shall be within the range of 6.6 to 9.0, temperature shall not exceed 30 °C (86 °F), turbidity shall not exceed 50 NTU, and dissolved oxygen shall not be less than 4.0 mg/l. Dissolved oxygen shall not be less than 5.0 mg/l as a 24-hour average. Values used in the calculation of the 24-hour average for dissolved oxygen shall not exceed the dissolved oxygen saturation value. For a measured value above the dissolved oxygen saturation value, the dissolved oxygen saturation value will be used in calculating the 24-hour average. The dissolved oxygen saturation value shall be determined from the table set out in Subsection O of 20.6.4.900 NMAC. The use-specific numeric standards set forth in this Part are applicable to the designated uses listed above in Subsection A of this section.

Flow

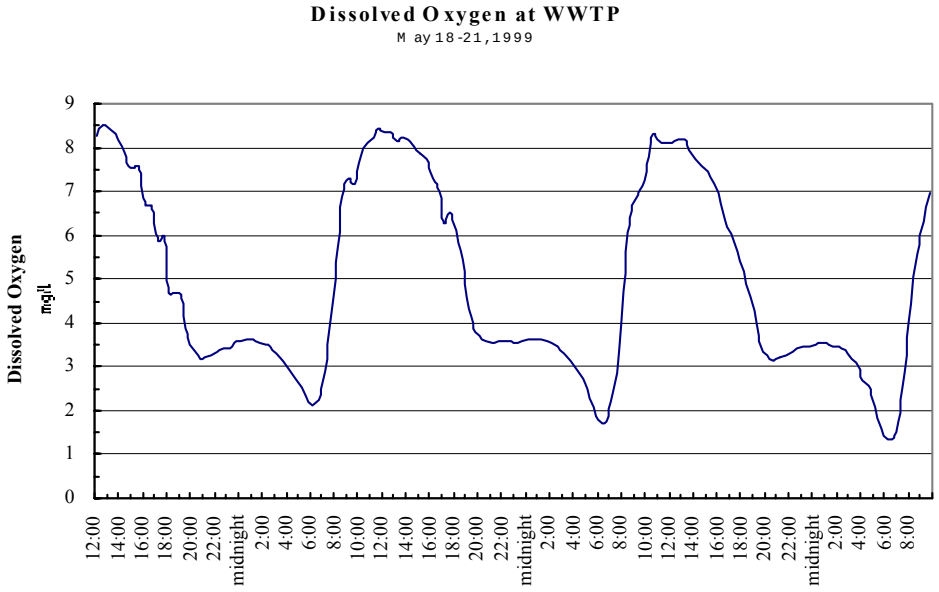
These TMDLs are calculated for a specific flow. In this case, since the upstream flow during most critical conditions at the Santa Fe WWTP is zero, the average design flow (8.5 mgd) from the WWTP was used as the flow for calculating the TMDL. This flow is consistent with the flow that will be used to establish the National Pollutant Discharge Elimination System (NPDES) permit.

Problem Definition

Figure 5 below shows the diurnal fluctuations in DO in the Santa Fe River at the site immediately downstream from the WWTP. These fluctuations routinely violate the DO water quality criterion of not less than 4 mg/L. These fluctuations are indicative of nutrient overenrichment in the Santa Fe River. The Santa Fe WWTP discharge to the Santa Fe River contains nutrients that contribute to growth of algae. However, the poor downstream condition of the stream and riparian area are the main contributors to excessive algal growth and violations of water quality standards.The algae reduce the levels of DO in the river during the early hours of the morning as a result of respiration. This reduction in DO can be a limiting factor for

aquatic communities in the Santa Fe River. The algae also increase the DO levels above saturation during warm, sunny afternoons. These super-saturated levels could be harmful to fish in some instances by causing gas-bubble disease in fish. A similar diurnal fluctuation was seen with pH.

Figure 5: Dissolved Oxygen Fluctuations in the Santa Fe River



Linkage of Water Quality and Pollutant Sources

Water quality sampling of the WWTP discharge and the Santa Fe River by the SWQB (1998-2000) provide sufficient evidence to link water quality to the Santa Fe WWTP discharge, since they are the only source of water in this reach of the Santa Fe River. Data collected downstream of the WWTP show violations of DO and pH criterion. The combination of the WWTP effluent, no upstream flow and less than ideal downstream riparian and geomorphic conditions contribute to excessive algal growth and violations of water quality standards.

The Santa Fe WWTP discharges very high quality effluent. The concentrations in the effluent are well within permitted limits and are anticipated to remain within any new permit limits developed subsequent to this TMDL. Updating the permit limits to reflect the loads established in this TMDL document will provide an assurance that future loads associated with the WWTP discharge will not exceed the TMDL waste load allocations. It is a combination of the downstream conditions of the stream and riparian area, lack of shade, and excessive algal growth that are driving the water quality impairment; not solely the quality of the WWTP discharge.

There are two potential contributors to nutrient enrichment, excessive nitrogen and excessive phosphorous. In order to determine which of these two nutrients is limiting an algal growth test was performed. Laboratory analysis of ambient waters showed that the limiting nutrient to the

Santa Fe River system was nitrogen. This means that the level of nitrogen in the river is driving the productivity of the algae. Therefore, nitrogen needs to be controlled to limit the excessive algal growth. The water quality model used in the development of this TMDL predicts the algal growth response to reduced levels of nitrogen. Since DO and pH are dependent on the algal biomass, reductions in algal biomass are expected to maintain DO and pH criterion.

In addition to nutrient loads, the in-stream oxygen level is impacted by the introduction of other oxygen demanding substances. This is expressed as the carbonaceous oxygen demand (5-day-CBOD5 or ultimate - CBODu). These three components, CBOD5, CBODu, NH3-N (ammonia), and nitrite (NO2) plus nitrate (NO3), must be controlled to maintain water quality standards for DO. This solution also predicted that the WWTP discharge must maintain a DO level of 5.0 mg/l.

This following section describes the calculations to compute the TMDL and associated load allocation (LA) and wasteload allocation (WLA). The calculated TMDL for CBOD5, CBODu, NH3-N, Nitrate + Nitrite, will maintain the revised DO and pH water quality standards adopted by the New Mexico Water Quality Control Commission on August 8, 2000.

Documentation of Calibrated Model

The EPA' s WASP/EUTRO modeling framework was selected to develop the water quality modeling for the Santa Fe River. The primary goal of the model is to simulate diurnal dissolved oxygen and pH fluctuations due to benthic (attached) algae in the study area. Since the WASP/EUTRO model was originally developed for suspended plankton in the water column, it was necessary to modify the code to accommodate important features for attached algae. First, the phytoplankton slot in the WASP/EUTRO model code was modified to simulate attached algae with necessary modifications. The WASP/EUTRO modeling framework has a unique feature that is crucial to modeling attached algae. That is, the mass transport functions controlling advective and dispersive flows may be turned on/off for any given system variables. In this case, the attached algae does not move with the transport. Another key feature making this model appropriate for this use is the incorporation of a pH module for estimating pH values in the stream. Additional justifications and discussion of this model are included in Appendix – A1-3 of this report.

Model Discussion and Results

The WASP/EUTRO model was calibrated using June 1999, field data collected by NMED instream at two sites; one immediately below the WWTP and the other approximately one mile downstream. The model was verified using data collected by NMED in July 2000. The calibration of the model requires adjusting several model parameters to mimic the observed DO and pH field datasets. The verification step was to confirm the model calibrated parameters. Both the calibration and verification runs of the model were comparable. The results of the model calibration and verification are presented in Appendix A-5 and A-6 of this report. The model predicted DO and pH profiles matched very closely with the observed data. The model calibration and verification runs used the WWTP effluent concentrations for the pertinent parameters and flow measured during field studies conducted by NMED.

Model Projections

Waste Load Allocations

For waste load allocations projection runs EPA used the calibrated/verified model as discussed above. For input to the model the facility design flow of 8.5 MGD was used. Several iteration of the model were run using a range of concentrations of the critical parameters. The model run with effluent concentrations for CBOD5, CBODu, ammonia nitrogen, nitrate+nitrite, and DO of 10 mg/L, 28 mg/L, 2 mg/L, 3 mg/L, and 5 mg/L respectively, met the dissolved oxygen and pH criteria. The results of the waste load allocation run are included in Appendix A-7 to this report.

Load Allocation

During the critical period, the primary source of water to the Santa Fe River comes from the WWTP, therefore the load allocation is zero.

Total Maximum Daily Load

The TMDL was calculated for the Santa Fe River using the point source design flow and effluent concentrations that will maintain the current DO and pH standards. The TMDL is equal to the wasteload allocation for the City of Santa Fe WWTP because the load allocation has been set to zero and the margin of safety is implicit in the conservative model assumptions. Results are presented in Table 1.

Table 1: Calculation of TMDLs

Parameter	WLA (lbs/day)	LA (lbs/day)	MOS (lbs/day)	TMDL (lbs/day)
CBOD5	708.9	0.00	Implicit	708.9
CBODu	1985.0	0.00	Implicit	1985.0
NH3-N	141.78	0.00	Implicit	141.78
Nitrate + Nitrite	212.67	0.00	Implicit	212.67

Consideration of Seasonal Variation

TMDL calculations are protective of standards at critical flows and will therefore be protective of standards at all flows. Thus, calculations made using the flow described above and using other conservative assumptions as described in the section on MOS, are protective at all times.

Margin of Safety (MOS)

Regulations require that TMDLs reflect a margin of safety based on uncertainty or variability of data, point and nonpoint source load estimates, and/or modeling analysis. For this TMDL, the

margin of safety is implicit in assumptions used in calculating the point source loads. The computer model included conservative assumptions as follows:

- •Using the design flow of the point source discharge rather than the actual flow, which is typically much lower.
- •Applying the critical temperature conditions for all twelve months.
- •Using the conservative re-aeration equation.
- •Using the conservative model decay coefficients.
- •Using a conservative CBODu/CBOD5 ratio.
- •Using site-specific data to calibrate and verify the model.

Allowance for Future Growth

Current flow at the wastewater treatment plant averages 5.9 mgd. The value of 8.5 mgd is the proposed average design flow in the draft permit from the U.S. EPA (April 17, 1999). This flow was used for all calculations in development of this TMDL. There remains sufficient treatment capacity to accommodate an increased flow of 44 percent. Therefore, no specific allowances for future growth will be made.

Other Information

Pollutant load monitoring for DO and pH will be implemented through the NPDES permit to address the link between water quality and the concentrations and loads of the permit.

Pursuant to Section 106(e)(1) of the Federal Clean Water Act, the SWQB has established appropriate monitoring methods, systems and procedures in order to compile and analyze data on the quality of the surface waters of New Mexico. In accordance with the New Mexico Water Quality Act, the SWQB has developed and implemented a comprehensive water quality monitoring strategy for the surface waters of the State. The monitoring strategy establishes the methods of identifying and prioritizing water quality data needs, specifies procedures for acquiring and managing water quality data, and describes how these data are used to progress toward three basic monitoring objectives: to develop water quality-based pollution controls, to evaluate the effectiveness of such controls and to conduct water quality assessments.

The SWQB utilizes a rotating basin system approach to water quality monitoring. In this system, a select number of watersheds are intensively monitored each year with an established return frequency of every five years.

The SWQB maintains current quality assurance and quality control plans to cover all monitoring activities. This document "Quality Assurance Project Plan for Water Quality Management Programs" (QAPP) is updated annually.

Current priorities for monitoring in the SWQB are driven by the 303(d) list of streams requiring TMDLs. Short-term efforts are directed toward those waters which are on the EPA TMDL consent decree (Forest Guardians and Southwest Environmental Center v. Carol Browner, Administrator, US EPA, Civil Action 96-0826 LH/LFG, 1997) list and which are due within the first two years of the monitoring schedule. Once assessment monitoring is completed those

reaches still showing impacts and therefore requiring a TMDL will be targeted for more intensive monitoring. The methods of data acquisition include fixed-station monitoring, intensive surveys of priority water bodies, including biological assessments, and compliance monitoring of industrial, federal and municipal dischargers, and are specified in the Assessment Protocol (SWQB/NMED 1998).

Long term monitoring for assessments will be accomplished through the establishment of sampling sites that are representative of the waterbody and which can be revisited every five years. This gives an unbiased assessment of the waterbody and establishes a long term monitoring record for simple trend analyses. This information will provide time relevant information for use in 305(b) assessments and to support the need for developing TMDLs.

This approach provides:

- o a systematic, detailed review of water quality data and allows for efficient use of monitoring resources.
- o information at a scale where implementation of corrective activities is feasible.
- o an established order of rotation and predictable sampling in each basin, which allows for enhanced coordinated efforts with other programs.
- o program efficiency and improves the basis for management decisions.

It should be noted that a basin will not be ignored during its four year sampling hiatus. The rotating basin program will be supplemented with other data collection efforts which will be classified as field studies. This time will be used to analyze the data collected, conduct field studies to further characterize identified problems, and develop and implement TMDLs. Both types of monitoring, long term and field studies, can contribute to the §305(b) and §303(d) listing processes.

The following schedule is for sampling seasons through 2002 and will be done in a consistent manner to support the New Mexico Unified Watershed Assessment (UWA) and the Nonpoint Source Management Program. This sampling regime allows characterization of seasonal variation through sampling in spring, summer, and fall for each of the watersheds.

1998 - Jemez, Chama (above El Vado), Cimarron (above Springer), Santa Fe, San Francisco
1999 - Chama (below El Vado), middle Rio Grande, Gila, Red River
2000 - Mimbres, Dry Cimarron, upper Rio Grande (part1)
2001 - Upper Rio Grande (part 2), upper Pecos (headwaters to Ft. Sumner), lower Pecos (Roswell south), Closed Basins, Zuni
2002 - Canadian Basin, lower Rio Grande, San Juan, Rio Puerco

Public Participation

Public participation was solicited in development of this TMDL. See Appendix B for flow chart of the public participation process. The draft TMDL was made available for a 30-day comment period starting **October 10, 2000**. Response to comments will be attached as Appendix C to this document. The draft document notice of availability was extensively advertised via newsletters,

email distribution lists, webpage postings (http://www.nmenv.state.nm.us), and press releases to area newspapers.

Implementation Plan

Management Measures

Management measures are "economically achievable measures for the control of the addition of pollutants from existing and new categories and classes of nonpoint sources of pollution, which reflect the greatest degree of pollutant reduction achievable through the application of the best available nonpoint source pollution control practices, technologies, processes, siting criteria, operating methods, or other alternatives" (EPA, 1993). A combination of best management practices (BMPs) will be used to implement this TMDL.

Several current and past Clean Water Act Section 319(h) projects indirectly address dissolved oxygen and pH problems in the Santa Fe River (see Appendix D). The project which most directly addresses this TMDL is the Santa Fe River Restoration Project being conducted by the Forest Guardians, who are continuing to work on City of Santa Fe land along the Santa Fe River. The purpose of this project is to enhance the riparian zone vegetation (partly to reduce temperatures), remove nutrients from the water, and decrease sediment discharge. The BMPs being implemented include temporary cattle exclusion, revegetating stream banks (*e.g.,* planting of willows and cottonwoods), and removal of a levee (to allow access of high flows to the flood plain). The created wetlands expected to form will directly address pH and DO problems in the river by removing a portion of the nutrient load. This project will also indirectly contribute to stabilized dissolved oxygen concentrations and pH in the Santa Fe River by inhibiting algal growth through decreased solarization, which is expected to result from increased shading by riparian vegetation and a concomitant decreased width to depth ratio of the river channel. With less algal growth, lower pH is expected in the day, because more CO_2 will be left in the water column with less photosynthesis by algae occurring. Higher DO is expected at night with less respiration by algae occurring.

A current Section 319(h) project that will provide important strategic information pertinent to addressing the array of water quality problems in the Santa Fe River is the Upper Santa Fe Watershed Restoration Project. This project includes as a deliverable a watershed restoration action strategy (WRAS) for the whole Santa Fe River watershed, to be provided by the Santa Fe Watershed Association. Delivery of a WRAS is specified as a task in the project work plan (which has been approved by EPA), with subtasks for each critical element identified in EPA guidance.

Stakeholder and public outreach and involvement in the implementation of this TMDL will be ongoing. The main vehicle of stakeholder involvement will be the WRAS, which includes components for public outreach, monitoring and evaluation, defining specific water quality problems, defining necessary actions to attain water quality goals, preparing an implementation schedule, and identifying funding sources to support implementation. Stakeholder participation will include choosing and installing BMPs, as well as potential volunteer monitoring. Stakeholders in this process will include: SWQB, FS, BLM, the NMSHD, local government, private landowners, environmental groups, and the general public. SWQB will work with the other stakeholders to refine and fund (where applicable, using CWA Section 319 grant funds) the BMPs identified in the WRAS.

Assurances

Permits (NPDES) issued under Section 402 of the CWA contain specific and legally enforceable effluent limitations and self-monitoring requirements. The EPA Region 6 Permits Branch is beginning the process of designing a new permit for discharge by the WWTP, and it is expected that the WWTP will be required to meet the limits specified in this TMDL. The customary timeframe for achieving compliance with new NPDES permit limits is three years with compliance being reached in the fourth year.

New Mexico's Water Quality Act does not contain enforceable prohibitions directly applicable to nonpoint sources of pollution. The Act does authorize the Water Quality Control Commission to "promulgate and publish regulations to prevent or abate water pollution in the state" and to require permits. The Water Quality Act (NMSA, 1978) also states in §74-6-12(a):

> *The Water Quality Act (this article) does not grant to the commission or to any other entity the power to take away or modify the property rights in water, nor is it the intention of the Water Quality Act to take away or modify such rights.*

In addition, The State of New Mexico water quality standards (Subsection C of 20.6.4.6 NMAC and Subsection C of 20.6.4.10 NMAC) states:

> *These water quality standards do not grant the Commission or any other entity the power to create, take away or modify property rights in water.*

New Mexico policies are in accordance with the federal Clean Water Act §101(g):

> *It is the policy of Congress that the authority of each state to allocate quantities of water within its jurisdiction shall not be superseded, abrogated or otherwise impaired by this Act. It is the further policy of Congress that nothing in this Act shall be construed to supersede or abrogate rights to quantities of water which have been established by any State. Federal agencies shall co-operate with State and local agencies to develop comprehensive solutions to prevent, reduce, and eliminate pollution in concert with programs for managing water resources.*

Milestones

Milestones will be used to determine if control actions are being implemented and standards attained. For this TMDL, initial milestones to be established are listed below. Milestones will be reevaluated periodically. Further implementation of this TMDL will be revised based on this reevaluation.

- Modify NPDES permit to include monitoring for parameters in this TMDL
- Track effectiveness of controls.
- Assess ambient water quality trends.
- Reevaluate TMDL for attainment of water quality standards.

References Cited

EPA. 1993. Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters. EPA-840-B-92-002. Washington, D.C.

EPA. 1994. Implementation Guidance for Water Quality Standards for Interstate and Intrastate Streams in New Mexico, EPA Region 6, Water Management Division, Permits Branch. September 21, 1994.

Forest Guardians and Southwest Environmental Center v. Carol Browner, Administrator, US EPA, Civil Action 96-0826 LH/LFG, 1997.

NMWQCC. 1995. State of New Mexico Standards for Interstate and Intrastate Streams. Santa Fe, NM.

SWQB/NMED. 1998. State of New Mexico Procedures for Assessing Standards Attainment for 303(d) List and 305(b) Report Assessment Protocol

APPENDICES

APPENDIX - A: Santa Fe River Model for DO and pH

A-1. Development of the Santa Fe River Water Quality Model to Simulate Diurnal DO and pH Fluctuations, prepared by Tetra Tech, Inc., November 23, 1999 (5 pages).

A-2. Calibrating Santa Fe River Water Quality Model, prepared by Tetra Tech, Inc., February 23, 2000 (10 pages).

A-3. Technical Approach - Modeling Diurnal Fluctuations of pH and DO in the Santa Fe River, prepared by Tetra Tech, Inc., September 22, 1999 (1 page).

A-4. Santa Fe River - Preliminary Reconnaissance, prepared by Tetra Tech, Inc., September 18, 1998 (3 pages).

A-5. Santa Fe River Water Quality Model Calibration using June 1999 data, prepared by Tetra Tech, Inc., Model Input/Output files (45 pages).

A-6. Santa Fe River Water Quality Model Verification using June 1999 and July 2000 data, prepared by U.S. EPA Region 6, TMDL Team, Model Input/Output files (45 pages).

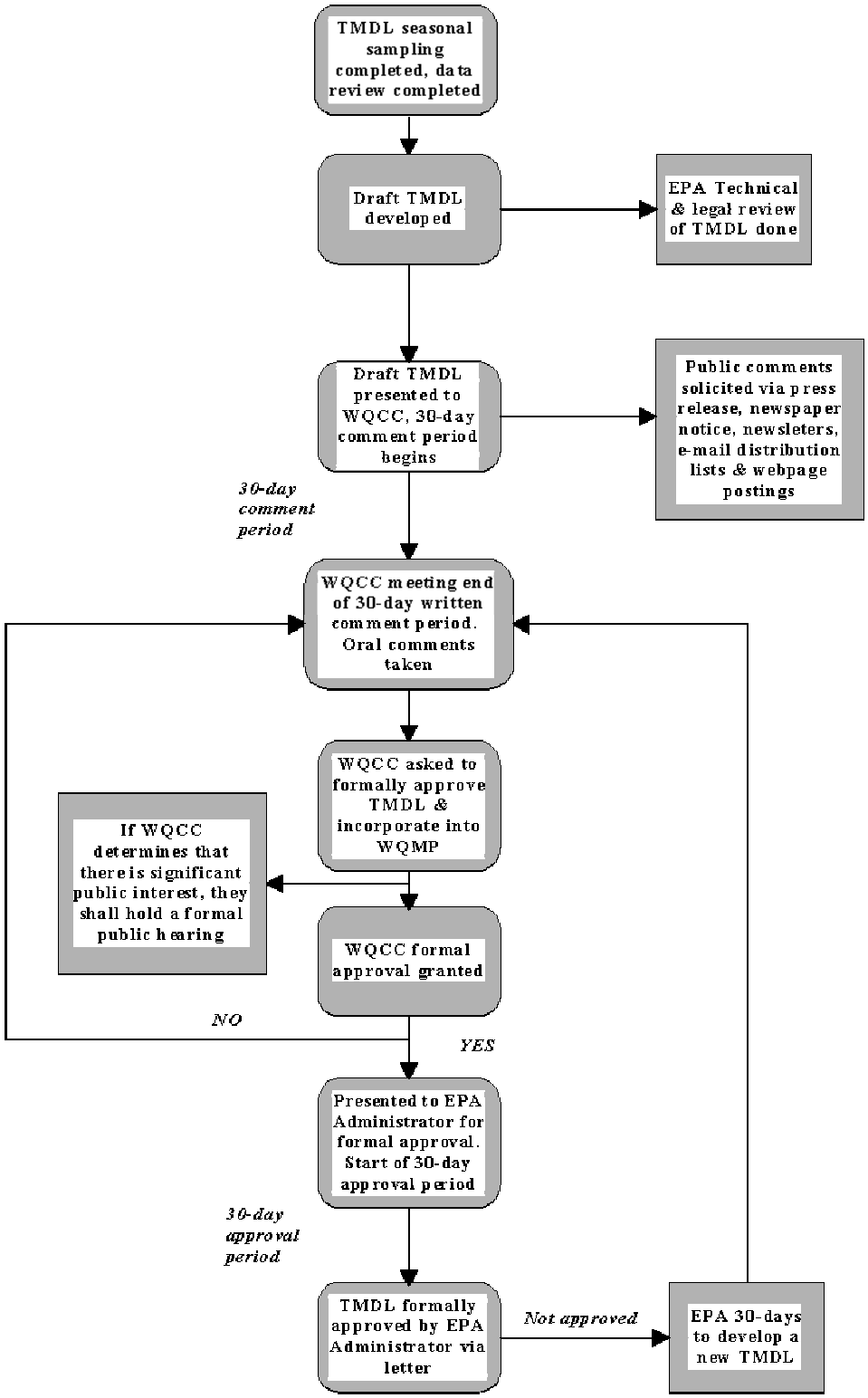
A-7. Santa Fe River Water Quality Model Projection Run for the City of Santa Fe Wastewater Treatment Facility, prepared by U.S. EPA Region 6, TMDL Team, Model Input/Output files (45 pages).

APPENDIX B: Public Participation Flowchart

APPENDIX C: Public Comments and Responses

APPENDIX D: Section 319 Projects in the Santa Fe River Watershed (submitted by the State)

APPENDIX B. PUBLIC PARTICIPATION



Appendix C:

One response was received during the public comment period. Jose Varela Lopez, a private citizen, provided three comments. His comment and the responses follow. Also attached is a copy of his original letter containing these comments.

C: According to recently released information in the Jemez Y Sangre Water Supply Study the dissolved oxygen and pH both fall within acceptable parameters outlined in the TMDL Draft Plan's Water Quality Criteria. I do not know why the numerical differences exist with respect to the two plans, but believe that the inconsistencies should be addressed.

R: The only pH or dissolved oxygen data presented in the Draft Jemez y Sangre Water Planning Region's Water Supply Study (August, 2000) are that of the National Water Quality Assessment (NWQA) administered by the U.S. Geological Survey. These data are median values for pH (8.5) and dissolved oxygen (102 percent saturation). The medians do not indicate what the maximum values for pH were, or the minimum values for dissolved oxygen. Violations of NM water quality standards are not based on medians. It is possible to violate water quality standards with only one sample. It is also possible to have violations of a standard in a data set that when a median is calculated, the median is not a violation of a standard. It is not clear that the NWQA data presented was collected using similar methods and measuring tools employed SWQB. SWQB employed continuous sampling for this TMDL (with example results summarized in Figure 5 of the draft TMDL), and any values above the standard for pH or below the standard for DO were taken as violations.

C: The State of New Mexico Surface Water Quality Bureau (SWQB) Implementation Plan also contains flaws. First of all, the Santa Fe River Restoration Project being undertaken by the Forest Guardians is not on land leased to them by BLM. The BLM is prohibited from leasing land for this type of undertaking. The Forest Guardians are in fact creating the riparian forest on property belonging to the City of Santa Fe. Secondly, the SWQB should realize that the BMPs being implemented on this project do not take into account the ephemeral nature of this section of the Santa Fe River. As such, extensive vegetation has never been a factor in this area. However, with the creation of this riparian forest along the flood plain, the SWQB and Forest Guardians have in effect greatly altered the prevailing ecosystem without any studies to address the consequences of such a project on downstream communities in general, nor private property in specific.

R2: You are correct that the Santa Fe River Restoration Project is being conducted on land owned by the City of Santa Fe. The document will be updated to reflect this.

With regard to your comment about the past condition of the Santa Fe River, please note that SWQB is not charged with restoring streams to their historical conditions (despite the suggestion implied by some project titles), but rather to enforce the New Mexico Water Quality Act, which recognizes designated uses for surface water and sets standards which are believed to protect those uses. If either the uses or the standards are believed to be inappropriate for a water body,

and sufficient evidence to that effect is available, then the New Mexico Water Quality Control Commission may amend the standards to better reflect reality.

With regard to the environmental impact of the Santa Fe River Restoration Project, you are correct that a detailed study has not been completed to assess the potential downstream impacts of the project. However, several features of the project are intended to improve downstream conditions. The vegetation that is being planted and encouraged is intended to strengthen the bank, with the desired outcome that less sediment will erode and be transported downstream. Providing access by flood flows to more of the flood plain in the project area will also reduce erosion and potential downstream flooding by slowing the floodwater.

C: The TMDL Draft also states that the Water Quality Act, "does not grant to the commission or to any other entity the power to take away or modify the property rights in water, nor is it the intention of the Water Quality Act to take away or modify such rights." This policy is also upheld under Federal Law. Therefore, given the fact that the State of New Mexico SWQB is allowing Forest Guardians to construct a riparian forest, and given the resulting consumptive use of water by said forest, it would appear that the SWQB is in fact abrogating the rights of senior water rights users downstream. This would appear to be a violation of both State and Federal Law. To the best of my knowledge no study has been completed or commissioned to deal with this matter.

R: The SWQB supports efforts to stabilize streambanks along the Santa Fe River. The Santa Fe River is impaired by not only dissolved oxygen and pH, but also by stream bottom deposits (TMDL previously approved Dec 1999). Stabilizing streambanks will help to decrease sediment loads into the river by decreasing the erosion of streambanks. Holding the streambanks in place with riparian vegetation also provides shade to the stream. This shade is necessary to reduce temperatures and direct sunlight to the stream, which drive the dissolved oxygen and pH problems in the Santa Fe River. The intent of stabilizing the streambanks along the Santa Fe River is to improve water quality so that water quality standards are being met. The SWQB believes that an additional benefit of shading streams would be decreases in evaporative losses. However, all inquiries related to water rights should be directed to the Office of the New Mexico State Engineer.

Appendix D: §319 Projects in the Santa Fe Watershed

Listed below are completed, current, and proposed Clean Water Act Section 319(h) nonpoint source pollution prevention projects administered by the New Mexico Environment Department Surface Water Quality Bureau in the Santa Fe River watershed. Any effect that each project may have on dissolved oxygen or pH in the Santa Fe River is briefly included.

The map below depicts the approximate locations of the projects.

1. La Bajada Mine Restoration (95-D, $107,922, Complete)
This project successfully demonstrated Best Management Practices (BMP's) on uranium mine tailings and the adjacent Santa Fe River, reducing detectable radiation downstream of the mine to meet water quality standards.

2. Santa Fe River Restoration (99-L, $143,840, In Progress)
The lead agency is the New Mexico State Land Office, which is partnering with the City of Santa Fe and the Santa Fe Watershed Association to mechanically improve the currently ephemeral portion of the Santa Fe River above the WWTP with enhancement of riparian growth and minimization of the erosion and sediment discharge that has occurred in this watershed. This project will indirectly contribute to stabilized dissolved oxygen concentrations and pH in the Santa Fe River by inhibiting algal growth through decreased solarization, which is expected to result from a decreased width to depth ratio of the river channel, which in turn is an expected outcome of reduced sediment supply. The reduced available light and resulting lower temperatures will both reduce algal growth. With less algal growth, lower pH is expected in the day (because more CO_2 will be left in the water column), and higher DO is expected at night (with less respiration by algae occurring).

3. Caja del Rio Project (99-N, $133,000, Proposed)
The lead agency is the US Santa Fe National Forest. The Forest Service plans to increase vegetation on damaged rangelands by drawing cattle away from riparian areas with a pipeline, fencing riparian areas, and burning sagebrush to enhance grasses. This project will indirectly contribute to stabilized dissolved oxygen concentrations and pH in the Santa Fe River by inhibiting algal growth through decreased solarization, which is expected to result from increased shading by riparian vegetation and a concomitant decreased width to depth ratio of the river channel.

4. Santa Fe River Restoration Project (00-E, $134,500, In Progress)
The lead organization is the Forest Guardians, who are continuing to work on land on the Santa Fe River leased by them by the Bureau of Land Management. The focus of this project is on enhancing the riparian zone to reduce temperatures, remove nutrients form the water, and decrease sediment discharge. The BMP's being implemented include temporary cattle exclusion, revegetating stream banks (*e.g.,* planting of willows and cottonwoods), and removal of a levee (to allow access of high flows to the flood plain). The created wetlands expected to form will directly address ph and DO problems in the river by removing a portion of the nutrient

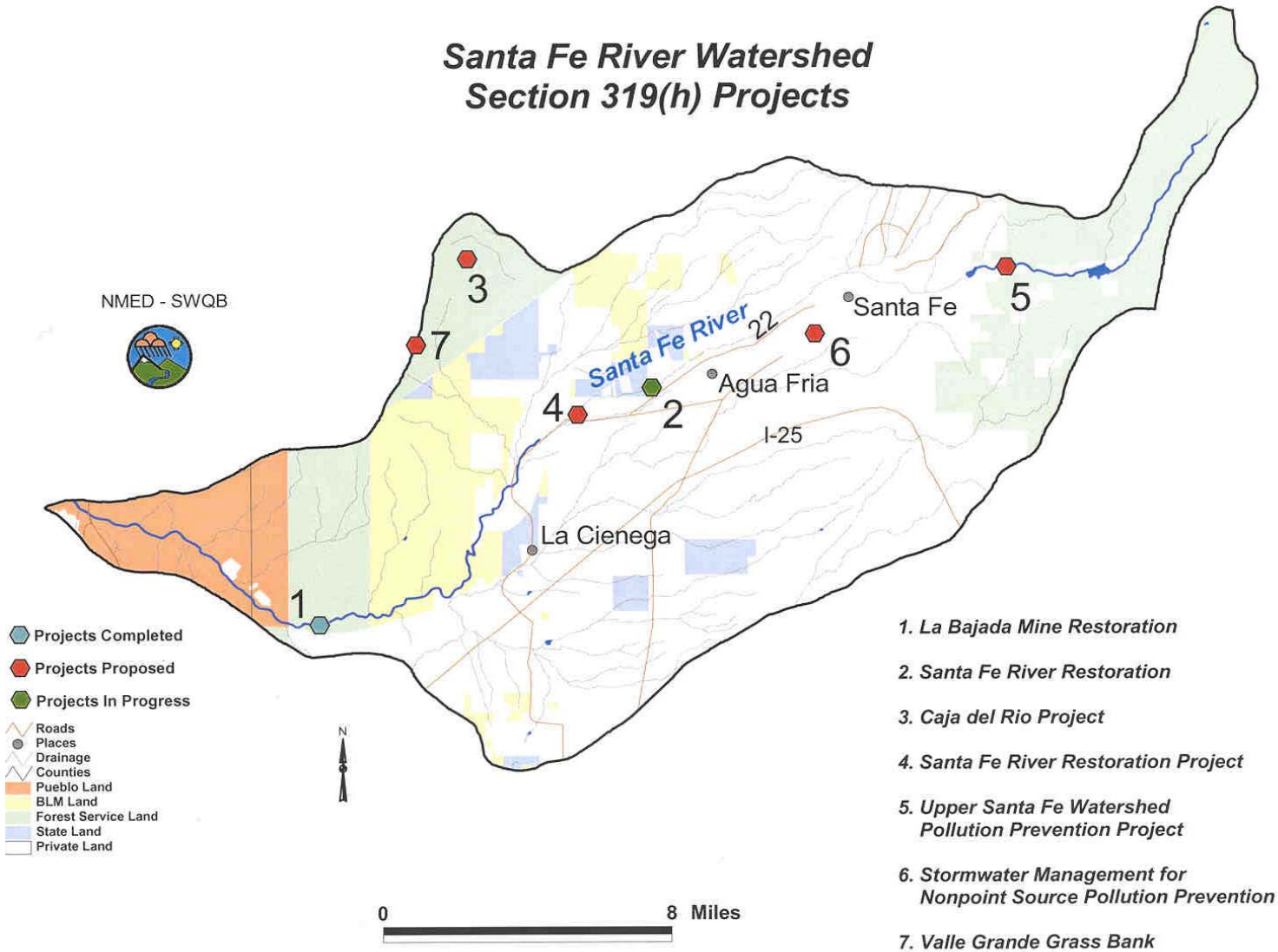
load. This project will also indirectly contribute to stabilized dissolved oxygen concentrations and pH in the Santa Fe River by inhibiting algal growth through decreased solarization, which is expected to result from increased shading by riparian vegetation and a concomitant decreased width to depth ratio of the river channel.

5. Upper Santa Fe Watershed Pollution Prevention Project (00-D, $736,450, Proposed)
The Santa Fe National Forest and City of Santa Fe propose to thin and burn 1100 ac of piñon/juniper and ponderosa forest in the upper Santa Fe River watershed. The upper watershed contributes 40% of Santa Fe's municipal water supply, and 70 years of fire suppression have resulted in very high fuel loading levels that increase the chances of a large intense wildfire that would reduce the quality or quantity of this water supply. Another component of the project that will be an important key to improving water quality in the listed portion of the Santa Fe River is the development of a watershed restoration action strategy (WRAS) for the entire Santa Fe River watershed. This WRAS is incorporated in an EPA-approved workplan as a deliverable and includes the components described as per EPA guidance on WRAS's.

6. Stormwater Management for Nonpoint Source Pollution Reduction in Santa Fe (97-N, $463,735, Proposed)
The City of Santa Fe proposes to implement urban runoff controls in the Arroyo de los Pinos channel and watershed. The Arroyo de los Pinos is an important tributary of the Arroyo de los Chamisos, which discharges a large amount of stormwater-driven sediment to the Santa Fe River. The proposed project will slow, detain, and utilize urban runoff to reduce peak flows reaching the Arroyo de los Chamisos. The on-the-ground project components will be used to illustrate effectiveness of a proposed drainage ordinance also to be developed with project funding. The reduction in peak stormwater flows expected from this project will be less erosive than current peak flows, allowing establishment of more riparian vegetation and a concomitant reduction in width to depth ratio of the stream channel. The resulting reduction in solarization will indirectly contribute to stabilized dissolved oxygen concentrations and pH in the Santa Fe River by inhibiting algal growth.

7. Valle Grande Grass Bank Composite Project (00-C, $541,417, Proposed)
The Conservation Fund proposes several coordinated range restoration projects on Forest Service land utilizing the Valle Grande Grass Bank. Proposed projects in the Santa Fe River watershed include erosion control using channel structures, slash lopping and scattering, and seeding on 250 ac of rapidly eroding land in the Cerrito Pelado area of the Caja del Rìo Plateau, and rest from grazing and prescribed burning on the Caja del Rìo Plateau and a portion of Rowe Mesa that is within the Galisteo River watershed. This project also includes an education program of outdoor workshops and conferences attended by ranchers from across New Mexico. The improved management of rangelands on the Caja del Rio allotment of the Santa Fe National Forest expected from this project will improve infiltration and reduce runoff to the Santa Fe River, with the indirect result of permitting more establishment of riparian vegetation and a concomitant decrease in width to depth ratio of the stream channel. The resulting reduction in solarization will indirectly contribute to stabilized dissolved oxygen concentrations and pH in the Santa Fe River by inhibiting algal growth.

Santa Fe River Watershed
Section 319(h) Projects



1. *La Bajada Mine Restoration*
2. *Santa Fe River Restoration*
3. *Caja del Rio Project*
4. *Santa Fe River Restoration Project*
5. *Upper Santa Fe Watershed Pollution Prevention Project*
6. *Stormwater Management for Nonpoint Source Pollution Prevention*
7. *Valle Grande Grass Bank Composite Project*